Diagnostic decisions in diabetes

PAT PHILLIPS MB BS, MA(Oxon), FRACP, MRACMA, GradDipHealthEcon(UNE)

This endocrine education section uses case scenarios to educate doctors on the best approach to the diagnosis and management of patients with different endocrine problems.

Question 1. ***Dennis is 68 years of age and is embarrassed because his wife, Debbie, persuaded him to come and get a diabetes check because she thinks he's likely to have diabetes. He feels well.***

Which two pieces of the advice should you give him at this stage?

a. He has an approximately 4% chance of having undiagnosed diabetes
b. He has an approximately 16% chance of having prediabetes
c. His lifetime risk of developing diabetes is approximately 5%
d. He is unlikely to have diabetes if he has no symptoms of hyperglycaemia

Discussion

The Australian Diabetes, Obesity and Lifestyle study found that 8% of the population had diabetes (4% diagnosed and 4% undiagnosed) and a further 16% had prediabetes (impaired fasting glucose [IFG], and/or impaired glucose tolerance [IGT]) – that is, about one in four had abnormal glucose tolerance.[1] Moreover, 60% of Australian adults are overweight (BMI 25 to 30 kg/m^2) or obese (>30 kg/m^2).

Currently, the average lifetime risk of diabetes is approximately 10% in Europid populations and higher in the higher risk populations. This risk is also increasing worldwide. The presentation of diabetes is also changing with fewer people having the classic symptoms of the 'polys' (polydipsia, phagia, uria and weight loss), the dramatic comas of diabetic ketoacidosis (in type 1 diabetes) or hyperosmolar nonketosis (in type 2 diabetes).

ENDOCRINOLOGY TODAY 2012; 1(2): 38-40

Dr Phillips is a Consultant Endocrinologist at the QE Specialist Centre, Woodville, SA.

More cases are now diagnosed incidentally in asymptomatic people when biochemical testing includes measurement of glucose levels.

Answers: a and b.

Question 2. ***Dennis asks if his insulin levels could also be checked as a friend of his was checked for diabetes and was told he had high insulin levels and should restrict his carbohydrate intake.***

How should you advise him? Please select two answers.

a. He may well have high insulin levels
b. His insulin levels should be checked
c. If he does have high insulin levels he will develop diabetes
d. His insulin levels will not give any useful information

Discussion

The pathophysiology of type 2 diabetes includes components of increasing insulin resistance and decreasing insulin secretion. People are born with a certain level of insulin resistance and insulin capacity related to their genes and their intrauterine environments. As the years progress, insulin resistance increases as we become less active, less muscular and fatter. The capacity to secrete insulin decreases because of the ageing of the beta cell population. Initially, insulin secretion can match insulin resistance and higher insulin levels control blood glucose levels. When insulin levels exceed the upper limit of normal, hyperinsulinaemia is diagnosed. When insulin resistance exceeds possible insulin secretion, the blood glucose level increases outside the normal range. Insulin levels remain high until the capacity to secrete insulin is greatly reduced when insulin levels fall into the normal range. Insulin levels at any one time only reflect the interaction of insulin resistance and insulin secretion. The high insulin levels do not tell you any more than the clinical picture. Checking insulin levels is therefore not useful in the diagnosis or management of people with type 2 diabetes, unless unexplained hypoglycaemia prompts investigation for an insulinoma.

Answers: a and d.

Question 3. ***Dennis is 178 cm tall and weighs 90.6 kg (BMI 28.6 kg/m^2). He has struggled with his weight most of his life and particularly since he developed a 'real sweet tooth'. His father developed diabetes at the age of 52 years and died at age 62 years of a heart attack.***

Which one is the largest risk factor for Dennis to have type 2 diabetes?

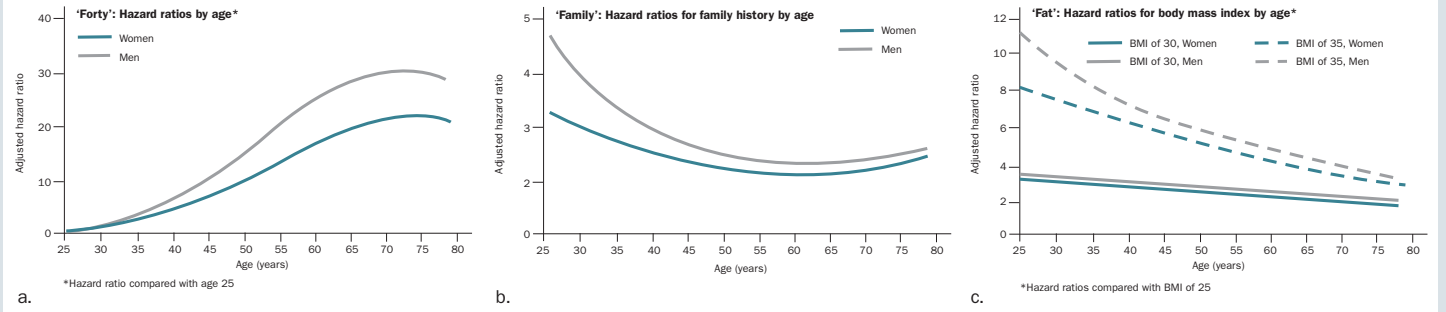
a. His weight
b. His high sugar intake
c. His age
d. His positive family history

Discussion

Risk of developing type 2 diabetes is largely predicted by the 'f' words of forty (over 40), family (positive family history) and fat (BMI >25 or 30 kg/m^2; see Figures 1a to c).[2] Dennis' age (68 years) gives him a hazard ratio (HR) of approximately 30 (Figure 1a), whereas his positive family history and overweight are associated with HRs of approximately 2.5 (Figures 1b and c, respectively). In a younger population (under 40 years and even more so in those under 25 years) the 'f' words of family and fat become much more important. For example, in an overweight man aged 40 years with a positive family history, the respective HRs of the three 'f' words are approximately 4 (forty), 3 (family) and 6 (fat). At 25 years of age, the ranking of the importance of the three 'f' words is different again with values of approximately 1, 4.8 and 3.8. In a younger (<40 years) obese population (BMI >30 kg/m^2) fatness becomes the dominant 'f' word (Figure 1c).

Although many believe high glucose levels or sugar intake is the major cause of type 2 diabetes, sugar contributes to diabetes risk mainly if it increases energy intake and fatness.

Answer: c.



Figures 1a to c. Diabetes 'f' words: forty, family and fat. Age interactions for men and women at risk of type 2 diabetes.[2]

Reproduced from: Hippisley-Cox J, Coupland C, Robson J, Sheikh A, Brindle P. Predicting risk of type 2 diabetes in England and Wales: prospective derivation and validation of QDScore. BMJ 2009; 338: b880. (Open access.)[2]

Question 4. ***You decide to test Dennis for the presence of diabetes.***

Which one is the most appropriate test?

a. Checking his random capillary blood glucose level (BGL) on your blood glucose meter
b. Arranging for a 75 g oral glucose tolerance test (OGTT)
c. Checking his fasting laboratory venous plasma glucose level
d. Checking his HbA_{1c} level

Discussion

The intra individual variability of a random BGL is much greater than for a fasting value and the result is less likely to give a clear indication if Dennis has dysglycaemia (IFG, IGT or diabetes). At present, an OGTT is the gold-standard test for diagnosing diabetes but an OGTT would be more expensive, time consuming and inconvenient compared with measuring the fasting glucose level. The HbA_{1c} level is used to diagnose diabetes in some countries with the diagnostic level set at ≥6.5% and is likely to be adopted in Australia in the near future. However, at present this test is only subsidised by Medicare for monitoring people with diagnosed diabetes.

Answer: c.

Question 5. ***You arrange for Dennis to have his fasting plasma glucose level checked. The result is 6.7 mmol/L.***

Which three of the following are correct?

a. The test result is abnormal and indicates an increased risk of diabetes and cardiovascular disease
b. If he continues as is, he has approximately 30% chance of developing type 2 diabetes in the next three years
c. If he makes significant changes to his lifestyle he would have approximately 15% chance of developing type 2 diabetes in the next year
d. He should now have an OGTT

Discussion

Dennis' result shows prediabetes (IFG), which has implications in terms of his risk of developing cardiovascular disease and type 2 diabetes. The Diabetes Prevention Program assessed the effect of three interventions in terms of developing diabetes in overweight adults with prediabetes (IGT).[3] These interventions were: placebo; metformin 850 mg twice daily; and intensive lifestyle modification. The trial was stopped after an average follow up of three years because there was a statistically and clinically significant difference between the groups in the numbers developing diabetes each year. The results were as follows:

- in the placebo/general lifestyle advice only group, the risk of developing diabetes was 11%
- in the metformin group, the risk of developing diabetes was 7.8%
- in the intensive lifestyle modification group, the risk of developing diabetes was 4.8%

In people with prediabetes the rate of diabetes development varies from 3 to 11% annually, although rates vary in different studies.

The RACGP recommends that an OGTT be performed if the fasting plasma glucose level is 5.5 to 6.9 mmol/L or if a random plasma glucose level is 5.5 to 11.0 mmol/L because diabetes is uncertain at these levels.[4*]

Answers: a, b and d.

Question 6. ***Dennis has an OGTT and the results are: fasting BGL = 6.7 mmol/L; 1-hour plasma glucose level = 12.1 mmol/L; 2-hour plasma glucose level = 9.8 mmol/L.***

Which one of the following is correct?

a. He has impaired glucose tolerance
b. The combination of his abnormal fasting BGL and 2-hour value is diagnostic of diabetes
c. The combination of his abnormal fasting BGL and 1-hour value is diagnostic of diabetes
d. His 1-hour BGL is diagnostic of diabetes

Discussion

Dennis has IFG (fasting plasma glucose level of 6.1 to 6.9 mmol/L) and IGT (2-hour plasma glucose of 7.8 to 11.0 mmol/L). The interpretation of the OGTT is based on the fasting BGL and 2-hour plasma glucose level. In the past, when urinalysis for glucose was used to monitor glycaemic control, fasting BGL and 1-hour and 2-hour plasma glucose levels were measured. Because these three values were usually different, a comparison of urinalysis of double-voided urine samples collected at the same time helped to define the renal threshold for glucose (the BGL at which urine first becomes positive for glucose). The 1-hour value may be assessed by researchers, but is less reliable as a measure of glucose tolerance than the 2-hour value and it does not influence the clinical interpretation of OGTT results (and adds extra cost and discomfort).

The diagnosis of diabetes requires two features, which are:

- at least two blood glucose values in the diabetes range on different days, or
- one blood glucose value in the diabetes range and symptoms characteristic of diabetes (e.g. the 'polys').

Answer: a.

*See the flowchart in the article 'Diabetes as the years progress' on page 9 of this issue.

Question 7. ***You explain to Dennis that he has pre-diabetes and should try to change his lifestyle.***

Which two other conditions should you check in Dennis?

a. Hypertension
b. Asthma
c. Dyslipidaemia
d. Paget's disease of bone

Discussion

Dennis has two of the features characterising the metabolic syndrome (overweight/overwaist and dysglycaemia).[5] The other basic components of the metabolic syndrome are cardiovascular risk factors (including hypertension and dyslipidaemia; see the box on this page). There are also other problems associated with central/visceral/abdominal overweight/obesity and these are: hyperuricaemia, polycystic ovary syndrome, nonalcoholic fatty liver disease or nonalcoholic steatohepatitis, and sleep apnoea. Further adverse effects of overweight/obesity are psychosocial, arthritic and logistical effects (e.g. special equipment required in hospital), and other problems associated with type 2 diabetes include osteoporosis and psoriasis.

Answers: a and c.

Question 8. ***Considering Dennis has prediabetes recognised what actions should be considered at this stage?***

Which two of the following are correct?

a. Prompt screening for diabetic retinopathy and nephropathy
b. Consideration of metformin
c. Screening for neuropathy
d. Intensifying lifestyle change

Discussion

According to the Australian Diabetes Society Position Statement on prediabetes, priorities in care are intensifying lifestyle change with diet (aiming to reduce body weight by at least 5% and total caloric and saturated fat intake).[6] Exercise is also recommended, along with tight blood pressure and lipid control with targets similar to people who have diabetes. Metformin at 850 mg twice daily, for example, is an off-label indication to add if lifestyle is not adequate in care. Screening for microvascular complications of diabetes and neuropathy is not indicated in patients with prediabetes.[6]

Answers: b and d.

Question 9. ***Dennis is prepared to eat less, walk more and move towards his healthy weight goal, but he is now concerned about his two children – a daughter aged 38 years (healthy weight) and a son aged 40 years (BMI >30 kg/m^2). He asked if they should be tested for diabetes.***

Which one of the following is correct?

a. Only the daughter should be tested
b. Only the son should be tested
c. The daughter and son should be tested
d. Not now, but both should be considered for testing after age 55 years

Discussion

The RACGP[7] and National Health and Medical Research Council recommend regular screening of all adults over the age of 40 years for diabetes every three years using the risk assessment questionnaire validated in Australia (available at www.ausdrisk.com). High-risk individuals should be screened by laboratory (not desktop capillary) measurement of the BGL. Apart from those identified by an AUSDRISK score, the following people should also be tested:

- people with IFG and/or IGT
- high-risk groups including those aged over 35 years; Aboriginal and Torres Strait Islanders, Pacific Islanders, and those from India or of Chinese origin
- people aged 40 years or older who are obese or have hypertension
- obese women with polycystic ovary syndrome
- people with clinical cardiovascular disease (e.g. coronary, cerebral, peripheral)
- people taking antipsychotic medications.

According to the guidelines, the following are also defined as high risk for diabetes: women who have had gestational diabetes; those age over 55 years, and those aged over 45 years with a first-degree relative with diabetes. However, any potential clinical/economic benefits in these three groups has not been defined.

Answer: b. **ET**

Basic components of the metabolic syndrome

Overweight/overwaist
- Increased body mass index
- Increased waist circumference
- Increased waist:hip ratio

Cardiovascular risk factors
- Increased blood pressure
- Abnormal triglycerides, high-density lipoprotein cholesterol level
- Prothrombosis
- Microalbuminuria

Glycaemia
- Impaired fasting glucose/impaired glucose tolerance/diabetes
- Insulin resistance

References

A list of references is available on request to the editorial office.

COMPETING INTERESTS: Dr Phillips has received research and travel grants, acted on advisory boards and been involved with clinical trials and seminars sponsored by a range of pharmaceutical companies. He does not think these associations have influenced the content of this article.